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CARBON PRICING AND ITS MONITORING SYSTEM AS A STATE REVENUE

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ABSTRACT

This study aims to examine the implementation of carbon pricing collection in Indonesia. This study also provides a review of the potentials for excise revenue, income tax (PPh), and value-added tax (VAT) from carbon emissions and an effort to build integrated supervision among stakeholders. This research uses descriptive qualitative method. The research data were obtained from a review of documents and regulations regarding carbon emissions. The research was conducted by comparing the best practices in the worldwide with the Indonesia government policy on carbon taxes. The results show a great potential for the country to apply carbon pricing collection through carbon taxes, carbon permits, or cap-and-trade (emission trading system). On the other hand, the collection of a tax on carbon or cap-and-trade schemes requires complex oversight. Therefore, a synergy between institutions is needed, such as the Directorate General of Taxes (DJP), the Financial Services Authority (OJK), and the Ministry of Environment and Forestry (KLHK). The digitization of the system and the establishment of a data warehouse are the main strategies to support the performance of the task force involving the three institutions in implementing joint audits. The recommendation from this research is that Indonesia should immediately implement the carbon pricing policy and form joint audits in monitoring its implementation. This research encourages further research on carbon pricing, carbon tax, PPh and VAT, as well as research on the economic impact of the policy at each level of carbon emission rates.

Keywords: cap-and-trade, carbon permit, carbon pricing, carbon tax, integrated system

JEL Classification:
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INTRODUCTION

Development policy that prioritizes green economy is a priority for countries globally as part of the sustainable development goals (SDGs) to be achieved by 2030. The green economy is also a concern for the Indonesian government. This green economy is an alternative to achieve common prosperity and social equality. Furthermore, this economic approach substantially reduces the risk of environmental damage and ecological scarcity, low carbon emissions, resource-efficient, and reduce socially inclusive (United Nations Environment Programme, 2011). A green economic growth that is environmentally friendly can realize the independence of the food, energy, and maritime sectors. There are five targets of economic growth to be realized based on green activity, namely (1) sustainable economic development, (2) inclusive and equitable economic growth, (3) economic, social and environmental resilience, (4) healthy and productivity, and (5) reduced greenhouse gas emissions (FTA, 2021); Global Green Growth Institute, 2015).

In 2020, the Indonesian government officially stated that climate change is one of the issues in its national development. The climate change occurs because of the excess carbon emissions and less emphasis on the green economy. The spirit of reducing carbon emissions as part of a green economy is stated in the 2020-2024 National Medium-Term Development Plan (RPJMN). The development plan in the next five years has three priorities in developing the environment, namely improving environmental quality, mitigating disasters and climate change, and reducing carbon emission. Based on the Nationally Determined Contribution (NDC), the government seeks to reduce greenhouse gas emissions by 29 percent independently and 41 percent with international assistance by 2030 (Republik Indonesia, 2016).

The United Nations Panel on Climate Change stated that the carbon dioxide emissions trend is increasing (Christiansen et al., 2018). If the authorities successfully implement a national emission policy, then highly polluting industries will have to stop production, or companies may be charged additional taxes as indirect compensation for the negative impact. The impact of pollution may decrease the social and public welfare and should be handled by the carbon tax policies. A carbon tax is an effective policy to minimize carbon emissions production because the policy will control industrial production. Furthermore, the application of carbon tax policy becomes a new question in Indonesia. In response to carbon production and carbon tax levies to industry, at least three government bodies, tax authority, the Ministry of Environment, and financial services authority should have better data sharing on carbon production analysis.

APPLICATIONS FOR PRACTICE

- Based on Law Number 7 of 2021 concerning Harmonization of Tax Regulations, as of April 1, 2022, a new carbon tax has been implemented in Indonesia
- The study finds that carbon taxes have significant revenue potential for green economy financing Integrated supervision is needed among ministries and agencies to maximize state revenue

In 2021, the Indonesian government proposed amendments to the Law on General Provisions and Tax Procedures (KUP) to accommodate the green economic development by implementing a carbon tax. The government collects a carbon tax from those who produce carbon emissions. The polluter pays tax based on the environmental damage caused by the pollution. Thus, this levy is expected to reduce emission levels in Indonesia.

The tax authority has an obligation to levy taxes on industries producing carbon. This article addresses the following questions: how did the government implement carbon tax from industry to control air pollution? are they ready? how will the inter-government bodies collaborate in handling that issues? The government bodies include the Directorate General of Taxes, and the Ministry of Environment and Forestry of Indonesia.

LITERATURE REVIEW

Carbon Emission

Global warming is one of the main challenges of our time and the greatest threat to natural life, prosperity, and security (Mundial, 2018; Li et al., 2021). Carbon dioxide emissions are a major component of GreenHouse Gases (GHG), accounting for nearly two-thirds of all GHG emissions. The most significant carbon emission is CO_2 emissions, which account for about 72 percent of EGRK (Intergovernmental Panel on Climate Change, 2007; Sanglimsuwan, 2011). Batchelor (2018) reports that 2017 was a record year for natural disasters, including hurricanes, wildfires, heatwaves, and droughts, which cost 31 billion dollars globally. The World Health Organization (2014) estimates that around seven million people die each year from indoor air pollution. The majority of these deaths occurred in the least developing countries (Collier, 2008).

Air pollution due to CO_2 emissions has numerous negative externalities (Gans et al., 2017). First, air pollution affects public health, which gradually reduces air quality through chemical reactions in the atmosphere. Carbon monoxide, carbon dioxide, sulfur, and other pollutants are very harmful to the human respiratory system. Consequently, public health spending will increase both to prevent negative impacts and cure the diseases caused by air pollution. In addition, the environmental problems caused by chemical reactions in the atmosphere damage human respiration and the ozone system. The pollution also leads to a glasshouse effect that has lead to the melting of polar ice caps and the increase of sea levels within the last decade. Furthermore, people should prepare to tackle all these situations to protect the environment from disasters. The environmental changes also influence how we live and the whole planet lives. Third, the economic cost should be borne by not only the government but also by the public. Last, those measures will burden the goverment budget heavily. The government should pay special attention to overcome global warming issues (Badan Kebijakan Fiskal, 2020).

Mursinto & Kusumawardani (2016) show that air pollution in Indonesia in 2011 caused premature deaths, which resulted in forgone earning of IDR 227 trillion. Air pollution also causes various diseases that result in the loss of income and the health care costs of IDR 146 trillion. The total economic impact of the air pollution of IDR 373 trillion is about 5% of GDP, a considerable value for the economy of the country.

Furthermore, in 2020, there were 242 recorded climate-related extreme events, and total economic losses from these events reached US$178 billion (Romanello et al., 2021). Even though in 2016 the number of losses due to climate change was still around US$129.4 billion, the total loss from year to year continues to increase. On the other hand, Indonesia is also experiencing economic losses from climate change due to carbon emissions. Without government policy intervention, the potential financial loss in Indonesia due to climate change could reach IDR 115 trillion in 2024. The study of National Development Planning Agency (Bappenas) shows that climate resilience policies in 4 priority sectors: water, health, marine fisheries, agriculture. This policy can reduce the risk of GDP loss by up to 50.4 % in 2024 (Medrilzam, 2021).

Based on the Second Biennial Update Report of the Ministry of Environment and Forestry, the cost of climate change mitigation to achieve NDC reaches Rp. 3,461 trillion by 2030 (Kementerian Lingkungan Hidup dan Kehutanan, 2018). Meanwhile, according to the Indonesian Mitigation NDC Roadmap, the accumulated costs of climate change mitigation to achieve NDC (using the NDC approach) the cost of mitigation actions 2020-2030 reached IDR 3,779 trillion (IDR 343.6 trillion per year) (Kementerian Lingkungan Hidup dan Kehutanan, 2020). Therefore, the Indonesian government must allocate significant amount of funds to adapt to climate change which harms the environment.

Taxes

Many debates have taken place regarding tax-related policies and politics. However, taxes are recognized as a source of revenue for the government (Gans et al., 2017). Tax, according to the Indonesian Law on General Provisions and Tax Procedures (KUP), is mandatory contributions to the state owed by individuals or entities that are coercive according to the Law (Republik Indonesia, 2009a). Moreover, there is no compensation to the taxpayers. However, revenue collected is used for the benefit of the State for the greatest prosperity of the people. Taxes have a budgetary function and a regulatory function (Agustina & Umaimah, 2022); Dewi et al., 2021; Khasanah & Suwandi, 2021; Mardiasmo, 2016). The first function is related to the importance of taxes as a source of funds for the government to finance government expenditure. Meanwhile, the second role means that taxes can be used as regulation tools for the public.

According to Smith (1776) in the Wealth of Nations, the principles of tax collection are as follows. (1) Equality principle means that tax collection carried out by the state must be following the ability and income of taxpayers. The government must not act discriminatively against taxpayers. (2) Certainty principle describes that all taxes must be based on the law. So, those who violate the law will be subject to sanctions. (3) Convenience principle points out that taxes must be collected at the right time for the taxpayers (the best time), for example, when a new taxpayer receives his income or when the taxpayer receives a gift. (4) economics principle states that tax collection costs should be kept as economical as possible, lest the tax collection cost is greater than the results of tax collection.

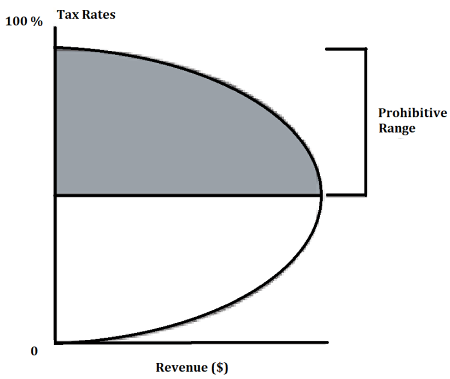
Taxes can be seen from the effect they have on state revenues and the national economy. The Laffer curve has the basic idea that changes in tax rates (up or down) have two effects, namely arithmetic and economic effects (Laffer, 2004). In the arithmetic effect, every increase in tax rates will trigger an increase in state revenue. On the other hand, if the tariff is lowered, the state income will also decrease. Furthermore, in terms of the economic effect, an increase in tax rates will reduce

production output and labour performance. It is because the higher the production yield, the higher the tax paid. On the other hand, a reduction in tax rates will positively impact on environment. Low tariffs are analogous to incentives that spur production to increase.

In general, arithmetic effects and economic effects work in opposite directions. Raising taxes will increase state revenues but can reduce economic growth. It works the other way around if the government lowers tax rates.

Figure 1. illustrates the concept of the Laffer Curve using state income variables and tax rates. The government will not collect tax revenues at 0 percent and 100 percent tax rates. At both points, the government will not get state revenue. A rate of 0 percent means that taxes are not collected. On the other hand, at a rate of 100 percent, no one will be willing to produce because all income will be taxed. The curve from point 0 to E is called the normal area, and from the point E to point 100 is called the restricted area (prohibitive range). It is a forbidden area because if the tax rate is more significant than point E, it can result in paralysis of economic activity and sluggish transactions between consumers and producers.

Figure 1. The Laffer Curve



Source: Laffer (2004)

Excise

According to the Excise Law of the Republic of Indonesia, excise is the state levy imposed on specific goods (Republik Indonesia, 2007; Sutartib & Nurkhamid, 2020). There are four characteristics mentioned in the law. First, its consumption needs to be controlled. Second, its circulation needs to be monitored. Moreover, its use can harm society or the environment. Lastly, its use is subject to government levies for justice and balance.

Products which are subject to the excise tax tend to be characterized by their unelastic demand curve (Godden & Allen, 2017). It can be said that when price goes up, order for the product decreases less than proportionately. It makes them a favourable source for raising national revenue. The government has often set high rates of excise duty for such goods to generate high revenue. Further, excise is a tax imposed on certain goods produced or imported for sale in a country. This tax is imposed by the government primarily as a special excise tax or ad valorem tax, and is collected from the manufacturer within a certain period after the product is delivered from the factory (World Bank, 2018). Based on the definition of excise, the carbon taxes tend to meet these criteria. A carbon tax as an excise tax is also a common practice internationally.

Retribution

Retribution is a regional levy as payment for services or the granting of certain permits specifically provided and/or given by the regional government for the benefit of private individuals or entities. Objects for retribution are public services, business services, and certain permits (Republik Indonesia, 2009b). Objects for Public Service Retribution are services provided by the regional government for public interest and benefit and can be enjoyed by private persons or entities. On the other hand, the objects for business services retribution are services provided by local governments adhering to commercial principles, which include; (1) services using/utilizing regional assets that have not been optimally utilized; and/or (2) services by the regional government as long as they have not been provided adequately by the private sector. Further, certain permit retribution objects are certain licensing services by the regional government for private persons or entities to regulate and supervise spatial use activities, use of natural resources, goods, infrastructure, facilities, or certain facilities to protect public interests and preserve the environment.

Non-Tax State Revenues

According to the law Number 9 of 2018, Non-Tax State Revenues (PNBP) are levies paid by persons or entities that gain benefits directly or indirectly f services or utilization of natural resources and rights obtained by the state based on statutory regulations (Republik Indonesia, 2018). This central government revenue is not included in the criteria for tax or grant revenue. It is managed in the state revenue and expenditure budget mechanism.

The objects of PNBP are all activities, things, and/or items that become a source of state revenue other than taxation and grants. PNBP includes revenue from the use of natural resources, service,

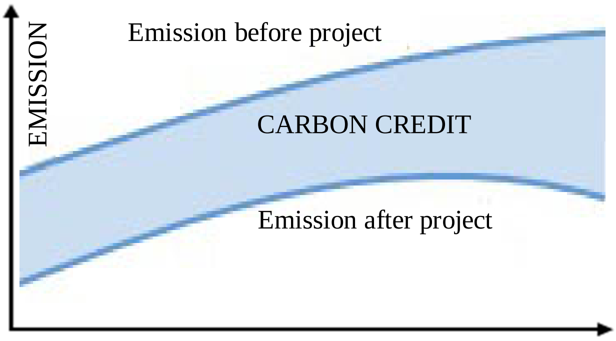
separate management of state assets, oversight of state assets, management of funds, and other state rights. PNBP objects must meet the criteria that have been determined in the law (Meiryani et al., 2022). First, the item relates to the implementation and duties of government. Second, the acquisition of objects comes from funds originating from the state revenue and expenditure budget. Third, objects are part of the management of state assets. Finally, there is the stipulation of laws and regulations on these objects.

Carbon Pricing

Carbon pricing can be used to determine the external costs of GreenHouse Gas (GHG) emissions (World Bank, 2020). This scheme arises because the community must bear the hidden costs of carbon emissions. Environmental damage due to carbon emissions needs to be calculated and charged. A carbon price is a form of compensation paid by the polluter to the community. Carbon pricing is used as a trigger for reducing carbon emissions. Emission producers will seek to reduce the burden of mandatory levies by making them efficient in generating emissions. The carbon pricing has many different schemes. One of the most well-known schemes is the Emission Trading System (ETS). This scheme provides certainty for the environmental impact, but prices remain flexible. Then, carbon taxes and carbon permits, on the one hand, have a certain impact on economic income but have a smaller contribution to environmental problems.

Next, one of the most popular types of carbon pricing is carbon credit (Figure 2). This system is called baseline-and-crediting. In this system, the commodities traded are emission reductions that have been certified based on the terms and conditions prevailing in the market. These commodities are also known as carbon credits. One unit of carbon credit is usually equivalent to a reduction in emissions of one tonne of carbon dioxide (Hindarto et al., 2018; Adhiyoso et al., 2021).

Figure 2. Carbon Credit Scheme



Source: Hindarto et al. (2018)

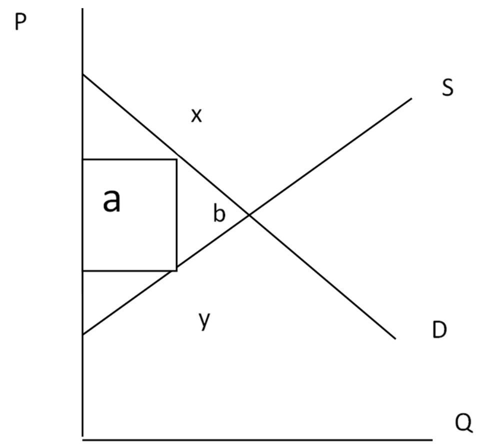
This system focuses on emissions at the project/activity level. It is not necessary to prepare and collect emission data at the installation/organization level. However, to find out baseline and actual emissions, a calculation and monitoring method is needed by the type of activity being carried out. Therefore, more types of activities and methodologies must be well prepared. For example, the methodology for calculating and monitoring emissions for solar energy as a source of electricity and composting from municipal solid waste is needed. The important thing in this type of carbon pricing is that there must be a methodology that all parties agree upon to implement emission reduction projects. The methodology should include the following:

a. Explanation of technology
b. Implementation limitations and requirements
c. Sources of emissions and types of greenhouse gases
d. Emission reduction calculation method
e. Other related data and parameters.

A carbon tax can be defined as a tax on the carbon content of fossil fuels. Since nearly all of the carbon in fossil fuels is eventually released as CO_2, a carbon tax is equivalent to CO_2 emission tax (Christiansen et al., 2018). Based on Law Number 7 of 2021 on the harmonization of tax regulations, a carbon tax is a tax imposed on carbon emissions that have a negative impact on the environment. Then, the carbon tax will be implemented in stages following a roadmap that will consider the development of the carbon market, achievement of NDC targets, sector readiness, and economic conditions. Furthermore, implementing a carbon tax will prioritize the principles of fairness and affordability by taking into account the business climate and small communities. The carbon tax rate is set higher or equal to the carbon price in the carbon market with a minimum rate of IDR 30.00 per kilogram of carbon dioxide equivalent (CO2e). The first implementation is on April 1, 2022, in the coal-fired power plant sector with a cap and tax scheme that is in line with the implementation of the carbon market that has already started running in the coal-fired power plant sector (Republik Indonesia, 2021).

A study in Australia stated that a carbon tax is one of the most effective policies to minimize coal and oil production in the mining industry (Humphreys, 2007). According to a study by (Meng et al., 2013) in the Environment Resource Economic Journal, a carbon tax will reduce carbon emissions. In addition, Humphreys, 2007), in Exploring a Carbon Tax for Australia, states that a carbon tax of A$ 15 per tonne would increase

Figure 3. Effect of Carbon Tax on prices



Source: Gans et al. (2017)

P : *Price*
Q : *Quantity*
S : *Supply*
D : *Demand*
a : *Tax revenue*
b : *Deadweight loss*

government revenues by about A$ 6.5 billion and A$ 30 per tonne would generate government revenues of A$ 13 billion. The effect of the carbon tax can be seen in Figure 3.

As can be seen in Figure 3, government revenues from the carbon taxes are shown in a square. The company (producer) will receive the price y, and the consumer must pay the price x. Consumers in the imposition of carbon taxes are the wider community who are the beneficiaries of goods or services subject to carbon tax rates. The beneficiaries of these goods or services will ultimately be subject to a tax burden by the producer. The tax burden is shared by increasing the price of goods or services. The difference between the two prices is a tax revenue for the government. The tax can encourage a higher price paid by consumers and a lower price received by producers. Carbon taxes are preferred over carbon trading systems because they are more efficient, effective, simple, flexible and transparent (Humphreys, 2007). More importantly, carbon taxes have the added benefit of providing income that can be used to cut other taxes. Therefore, a carbon tax may have little or no economic cost compared to other systems.

RESEARCH METHODOLOGY

This study employs a descriptive qualitative approach. Creswell states that qualitative research is a tool to explore and understand the views of individuals or groups related to social or human problems (Creswell, 2014). In the previous section, the researchers stated that carbon emissions produced by human activity have both positive and negative impacts on human beings. The activity of production may increase the economy and life quality and negative excess on pollution and global warming. The authors attempt to extract those problems by exploring several alternatives and studies from other countries' experiences on handling global warming problems. Data collection from the secondary source was conducted to create better analysis and comparison among the government and non government data. The researches also performed content analysis and observation from several studies on global warming and tax policy. Furthermore, the exploration in depth will provide several alternatives to handle research problems.

The previous researches applied many alternative tariffs to provide alternatives to carbon tax policy. Those suggestions were completed with effective data management to create comprehensive conclusions. This paper provides a report based on actual carbon tax policy and current conditions on carbon pollution from the industry. Moreover, data collection based on case studies may develop a real problem solved by the real policy on carbon tax in many governments. Consequently, different problems and alternatives shown in many experiences will enrich this research with in-depth analysis and conclusions. Data analysis was performed in two steps. Individual data was analyzed, followed by cross-case explorations. An individual case study was conducted to find several problems and policies from each country. Furthermore, it is followed by the policy from the government to handle each condition. On the other hand, the differences and similarities from region to region were examined to identify the characteristics of each case. In addition, international cases from European and American countries will be considered to expand and deepen the analysis of the Indonesian case. Lastly, national policy is an exercise based on the implementation of tariffs and penalties in developed countries.

This study uses data from government websites regarded as secondary data. The type of documentation in this research is an investigation of laws, procedures, and documentation related to each government policy on carbon tax pricing. Furthermore, the researchers added a comprehensive solution on data management to handle carbon tax problems.

The study uses an analysis of the implementation of the carbon tax in Indonesia based on the Law of the Republic of Indonesia

Number 16 of 2009 concerning General Provisions and Tax Procedures and the Law of the Republic of Indonesia Number 16 of 2016 concerning the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change (Yahoo & Othman, 2017). Furthermore, the use of tariffs as the basis for imposing a carbon tax elaborates on the document in the United States "Methodology for analyzing a carbon tax" by the US Department of the Treasury (Horowitz et al., 2017) and the data presented in the World Bank dashboard (World Bank, 2020). On the other hand, funding needs for mitigating the adverse effects of climate change refer to the Climate Change Mitigation and Adaptation Budget Report by the Fiscal Policy Agency (Badan Kebijakan Fiskal, 2020), the Indonesia Mitigation NDC Roadmap (Kementerian Lingkungan Hidup dan Kehutanan, 2020), and Second Biennial Update Report by the Ministry of Environment and Forestry or KLHK (Kementerian Lingkungan Hidup dan Kehutanan, 2018).

RESULT AND DISCUSSION

Total Carbon Emission in Indonesia

In 2017, Indonesia produced 1.150 million tonnes of CO_2e carbon emissions (Badan Pusat Statistik, 2019). Data from the Central Bureau of Statistics (BPS) shows that the energy sector and Forestry and Other Land Uses (FOLU) produce the highest carbon emissions with an average of around 500 million tonnes of CO_2e. The lowest carbon emission rate of all sectors is the Industrial Processes and Product Use (IPPU), which produces about 40 million CO_2e emissions. If the agriculture and wildfires sectors are excluded, Indonesia's average greenhouse gas emissions would be 1,041,675,000 tonnes CO_2e per year. This average is taken from 10 years of data from 2007 to 2017, which does not change significantly from year to year (see Appendix 1). The amount used as the base number of carbon emissions is used to calculate potential revenue from carbon pricing.

Possibility Tariff Adopted

According to Irama (2019), South Africa can be used as basis for benchmarking because of its economic growth perspective. Indonesia is also a developing country that has the right to reduce carbon emissions voluntarily. The rate used is US$ 5 which is used in the study by Irama. Meanwhile, data based on the carbon pricing dashboard as of November 2020, Singapore set US$ 3.66 for carbon tax tariff, while Argentina was US$ 5.96 and Japan was US$ 2.76 (World Bank, 2020). The US Department of Treasury issued a Working Papers Series which includes tariffs on carbon emissions from 2019 to 2028 in the US (Horowitz et al., 2017). The tariff is higher than the European Union Emissions Trading System of US $ 36, around US $ 54 per mt CO_2e in 2021.

For developed countries, the high carbon tax rates cannot be compared with the economic strength of developing countries like Indonesia. Therefore, this study uses two moderate lower and upper limits of US $ 3 and US$ 6 per tonnes CO_2e to estimate the potential state revenue from carbon tax in Indonesia.

Potential State Revenue

Carbon Pricing can be used as a tool that captures the external costs of GreenHouse Gas (GHG) emissions. Communities have to bear the hidden costs of carbon emissions. Environmental damage due to carbon emissions needs to be calculated and charged. Carbon emissions' harm to the environment can be measured through the CO_2 produced and released into nature. Previous research explained that the most significant carbon emissions are CO_2 emissions, which account for about 72 percent of EGRK (Intergovernmental Panel on Climate Change, 2007; Sanglimsuwan, 2011). Thus, every CO_2 thrown into the environment around humans must be subject to tariffs as compensation and a source of funding for environmental improvements. For example, Budi & Suparman (2013) stated that the amount of CO_2 emissions from Steam Power Plant (PLTU) is calculated using the emission factor (units of kg/kWh) in the steam power sector. The number of carbon emissions produced by the PLTU is obtained by multiplying the emission factor by the number of electrical energy generated. Thus, from each kWh of electricity produced, how many grams of CO_2 created and used as the basis for imposing a carbon tax will be known.

Furthermore, the economic impact is measured by the costs incurred due to human health problems, including mortality and morbidity (Künzli et al., 2000; Mursinto & Kusumawardani, 2016; Romanello et al., 2021). The measurement can be seen in Table 1. Common methods used to assess the cost of morbidity are loss of earnings and medical cost. Combining the two methods is often referred to as the Cost Of Illness (COI). Meanwhile, the estimation of mortality costs due to pollution uses a proxy for lost earnings due to premature death. This concept is known as the Value of Statistical Life (VSL). The method often used to estimate mortality costs is the Human Capital (HC) approach with the principle that the value of a person's life is determined by the level of work productivity, which is usually measured based on the present value of future income streams. The HC approach's

Table 1. Measurement of economic impact

Economic Impact	Cost	Method	Definitions
Morbidity	Cost of Illness	Loss of Earnings	the amount of reduction in income due to not coming to work
		Medical Cost	health care costs due to illness
Mortality	Forgone Earnings	Value of Statistical Life (VSL)	willingness to pay (WTP) for reducing the level of risk of death

Source: Romanello et al. (2021)

weakness is that it cannot estimate a person's preferences about the importance of his life. So, in practice, this approach is rarely used. As an alternative, VSL is usually estimated through the community's Willingness To Pay (WTP) for reducing, not avoiding, the level of risk of death.

Revenue from Carbon Tax or Permit

Nordhaus (2006) states that there are two schemes for limiting carbon emissions, namely the use of quantity-based and price-based limits. The quantity-based mechanism is known as a carbon permit. Polluters will buy emission quota permits and must comply with the specified limits. Another mechanism is price-based, namely levies such as carbon taxes, where payments are made per unit of CO_2e emissions produced (Calderón et al., 2016; (Ayu, 2018)). Carbon taxes mean that controlling carbon prices can directly reduce emissions levels. The principle of carbon tax is that whoever makes emissions must pay levies. Carbon tax and carbon permit in this study are directed to be levied in the central government tax category.

After the ratification of the Paris Agreement by Indonesia in 2016, Indonesia has an obligation to reduce GreenHouse Gas (GHG) emissions. This is part of Indonesia's contribution to the world in tackling climate change. According to Law Number 16 (Republik Indonesia, 2016), Indonesia is committed to reducing national GHG emissions in 2030 to 29 percent lower than the emission level without mitigation efforts. Furthermore, with international assistance, Indonesia's contribution could be increased by up to 41 percent (Republik Indonesia, 2016). These targets that have been determined in law Number 16 (Republik Indonesia, 2016) will be used to calculate potential revenue for the Indonesian government.

Formula I:

Potential state revenue= Estimated Carbon Emissions x Tariff per Tonne CO_2e

Carbon taxes and carbon permits are included in the central tax levy category so that their rates are the same. The potential state revenue obtained from carbon tax without reducing emissions is IDR 87,500 million. However, if there is a decrease of 29 percent, there will also be a proportional decrease to IDR 62,125 million. This value is a potential from year to year because Indonesia's carbon emissions are almost the same every year (see Appendix 2).

A carbon permit is almost the same as a carbon tax, but a carbon license clearly provides a limit on the carbon emissions allowed in the form of a certificate. Certificates purchased by polluters must be executed in compliance. Emissions that exceed the permitted limit will be subject to a large fine. The table below presents potential revenue from carbon permits at a rate of US $ 3 and a fine of US $ 20 per tonne of CO_2e.

Formula II:

Potential state revenue= (permitted emission x Tariff per Tonne CO_2e) + ((Total Carbon Emissions-CAP/permitted emission) x Fine Tariff per Tonne CO_2e)

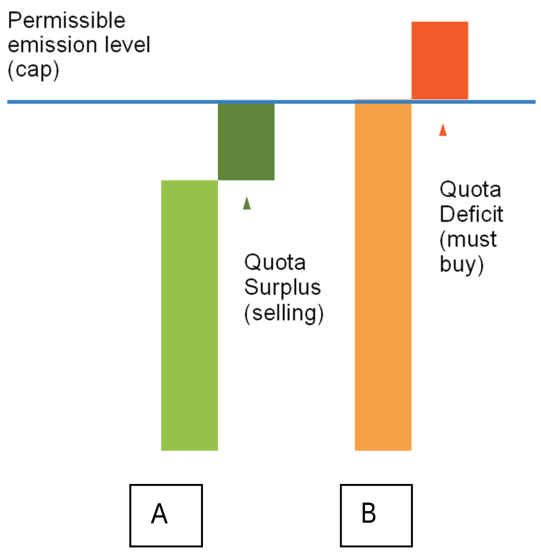
Carbon permits will force polluters to be more efficient and reduce the carbon emissions they produce. If there is no reduction in carbon emissions, the government can receive IDR 115,646,647 million in revenue at the reduction target rate of 29 percent. The potential for tax revenue is greater if the emission reduction target is 41 percent. Tax revenue will be around IDR 145,396,856 million (see Appendix 3).

Revenue from Cap-and-trade

Cap-and-trade is actually different from carbon permits, but it has similarities, both in terms of emissions and its implementation, which are mostly mandatory. The difference with a carbon permit is that cap-and-trade recognizes emissions trading so that emission quotas can be traded. At the "cap" limit, levy is not imposed on parties who produce carbon emissions. However, polluters who exceed the limit will be subject to heavy sanctions. Fine can be avoided if the party that

produces carbon emission over the limit buys a certificate of surplus emissions from another party.

Figure 4. Cap-and-Trade Scheme



Source: Hindarto et al. (2018)

Marks:

A: Company A
B: Company B

There are two possible schemes on a cap-and-trade method (Figure 4). First, if B does not buy an emission surplus quota from A when B has an overproduced carbon emissions, B has to pay a severe fine (just like on the carbon permit scheme). B is charged only for levy. Second, if B buys an emission surplus quota from A when B has an overproduction of carbon emissions, B has to collect Value Added Tax from purchases instead of pay tax/levy as a severe fine. Further, A has recognized sales as non-operating revenue and become the base of income tax. So, there is potential revenue from VAT and income tax (PPh).

Data Exchange and Data Service System

Regarding levy on carbon permit and tax on income from the sale of carbon surplus, additional data is needed by the Directorate General of Taxes (DJP) and KLHK data exchange mechanism. The data includes DJP data on elements of tax return such as non-operating income from carbon surplus sales and income tax payments on these sales. Data belonging to the KLHK that is being exchanged are carbon gas production requests, carbon tax stamp requests, and tax payments.

Carbon tax on the carbon quota mechanism and income tax on sale of carbon surplus depend on external data, namely carbon quota data and data on the realization of carbon emission from KLHK. Other external data that becomes input for DJP is the sustainability reports and financial reports from the Financial Services Authority (OJK) (see Appendix 4).

In realizing the single source of truth data concept, based on the Decree of the Minister of Finance of the Republic of Indonesia (KMK) Number 878/KMK.01/2019 regarding data governance within the Ministry of Finance, all data sourced from units within the Ministry of Finance which is the property of the Ministry of Finance, is managed through the Ministry of Finance's Data Service System (Republik Indonesia, 2019). In Appendix 4, DJP as data producers are responsible for providing data, determining data user access rights, and conducting cooperation with external parties, which are OJK and KLHK.

The Information and Communication Technology (ICT) unit as unit data custodian manages the Ministry of Finance's data management and presentation system in their unit, which is part of the Ministry of Finance's Data Service System. Data users (internal and external) can request Ministry of Finance data services by submitting requests for the use of Ministry of Finance data through the unit data custodian or central data custodian. In the case the data requested by the user has confidential and limited information/data, unit data custodian and/or central data custodian must first coordinate with data producers.

Taxes data in the carbon permit scheme is digital data that is submitted to the intended parties. Application data for carbon tax stamps is submitted through the pajak.go.id. Non-operating income data from sales of carbon surpluses and tax payments are conveyed through DJP's “djponline”. This data together with carbon emission data (KLHK) and sustainability reports (OJK) will form a database that can be used for various purposes, as in the image on Appendix 5.

The data warehouse will be managed by the DJP because of the mandate of the KUP law to maintain the confidentiality of taxpayer data. Taxpayer secrecy can be opened under permission from the minister of finance. As a result, under the authority of DJP, the permit to access taxpayer data can be processed and followed up immediately and smoothly.

Digital Based Task Force

In monitoring the fulfillment of company obligations that produce carbon emissions, synergy from several interested institutions is needed. The complexity in measuring carbon

emissions, the transaction of surplus quotas certificates, and the payment of carbon pricing require data exchange between several agencies. Tax collection is related to DJP, while measurement of emissions based on financial reports and field facts is based on the Financial Services Authority (OJK) supervision and the Ministry of Environment and Forestry (KLHK).

The Financial Services Authority (OJK) Regulation Number 51/POJK.03/2017 concerning the Implementation of Sustainable Finance for Financial Service Institutions, Issuers, and Public Companies demands sustainability reports through annual reports presented by the regulated companies. The sustainability report must present the carbon emissions produced by these companies (Otoritas Jasa Keuangan, 2017). Therefore, OJK can be involved in monitoring the number of carbon emissions produced by companies as a means of confirming the reliability of a company's sustainability report.

Moreover, based on Article 49 (3) of Law Number 32 of 2009 concerning Environmental Protection and Management, the implementation of environmental audits of certain high-risk activities is carried out periodically. An environmental audit is an evaluation carried out to assess the compliance of entities in charge of a business and/or activity with legal requirements and policies set by the government (Republik Indonesia, 2009c). The audit was conducted by auditors from the Indonesian Ministry of Environment and Forestry (KLHK). Therefore, KLHK must be involved in measuring emissions by polluters based on field data and facts.

Collaboration task force figure (see Appendix 6) shows that DJP imposes an excise on carbon emissions per metric ton. At the same time, DJP imposes Income Tax on sales of carbon emission quotas and supervises VAT collection by quota buyers (Cap-and-Trade scheme). Furthermore, OJK and the KLHK auditors are involved in the assessment of the carbon emissions produced and traded by market players. The assessment results by OJK and KLHK are used as input for DJP as a basic comparison of carbon tax payable.

Data from the three institutions above is stored in the data service subsystem database of the Ministry of Finance under the DJP's data custody. Through intelligent data processing as described in the previous subsection, the database is processed and displayed to specific users: DJP, as a digital tool and support digital auditing.

The digital tool above follows the logic model below:

Actual Carbon Emission Volume = Carbon Quota Volume - Sales Volume of Surplus Quota + Purchase Quota Volume + Volume Subject to Fines

The actual volume of carbon emission according to KLHK must be equal to the quota of carbon volume reported to DJP for payment of levy. If there is a quota surplus or deficit, the sales/purchase volume reported to the DJP will be reduced or added to the quota. However, if there is a quota deficit but no purchases, there will be a large fine that is reported to KLHK and the volume will increase the quota.

CONCLUSION

Carbon pricing is a solution that can be put forward for protecting the environment and earning national income. The country's income is compensated for the negative externalities generated by the polluters. Indonesia can apply a carbon tax or carbon permit and Emission Trade System (ETS), also known as the Cap-and-Trade scheme. Integrated supervision is needed in the application of carbon pricing. The potential for optimal state revenue can be realized if there is a synergy between DJP, OJK, and KLHK. A maintained environment and increased state revenue can be created with the mutual collaboration between institutions. The potential for a minimum revenue of up to 51 trillion IDR (carbon tax) and 145 trillion IDR (carbon permit) per year should be realized if the government immediately drafts rules regarding carbon pricing in Indonesia. Accelerating the application of carbon pricing will pressure polluters to control carbon emission production so that the reduction target based on Law Number 16 of 2016 can be achieved.

IMPLICATION AND LIMITATION

This study uses a qualitative approach by reviewing documents and regulations. It does not provide an understanding of stakeholders' perceptions in calculating tax potential and the information system to be built. The researchers also do not calculate the non-taxable emission quota, which is not taxable until it exceeds the cap. This is because it requires a literature study and an interview approach with stakeholders. After all, it is related to socio-economic policies.

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APPENDIX

Appendix 1

Table. Greenhouse Gas Emissions by Type of Sector (thousand tonnes CO_2e), 2001-2017

Years	Sectors						
	Energy	IPPU	Agricultural	Waste	FOLU	Wildfires	Total
2007	402.989	35.919	101.487	83.933	553.803	62.747	1.240.878
2008	391.784	36.499	98.659	85.023	513.712	81.744	1.207.420
2009	405.653	37.546	102.956	89.326	620.566	299.920	1.555.967
2010	453.235	36.033	104.501	87.669	383.405	51.383	1.116.226
2011	507.357	35.910	103.161	91.853	427.310	189.026	1.354.617
2012	540.419	40.078	106.777	95.530	487.928	207.050	1.477.781
2013	496.030	39.110	106.814	100.515	402.252	205.076	1.349.797
2014	531.142	47.489	107.319	102.834	480.033	499.389	1.768.206
2015	536.306	49.297	111.830	106.061	766.194	802.870	2.372.559
2016	538.025	55.307	116.690	112.351	545.181	90.267	1.457.821
2017	558.890	55.395	121.686	120.191	282.098	12.513	1.150.772

Source: Badan Pusat Statistik, 2019

Appendix 2

Table. Potential state revenue obtained from carbon tax

No	Estimated Carbon Emissions	Tariff per Tonne CO_2e (US$)	Revenue US$	Revenue IDR
1	1.041.674.000	3	3.125.022.000	43.750.308.000.000
		6	6.250.044.000	87.500.616.000.000
2	739.588.540 (Reduced 29%)	3	2.218.765.620	31.062.718.680.000
		6	4.437.531.240	62.125.437.360.000
3	614.587.660 (Reduced 41%)	3	1.843.762.980	25.812.681.720.000
		6	3.687.525.960	51.625.363.440.000

Source: processed

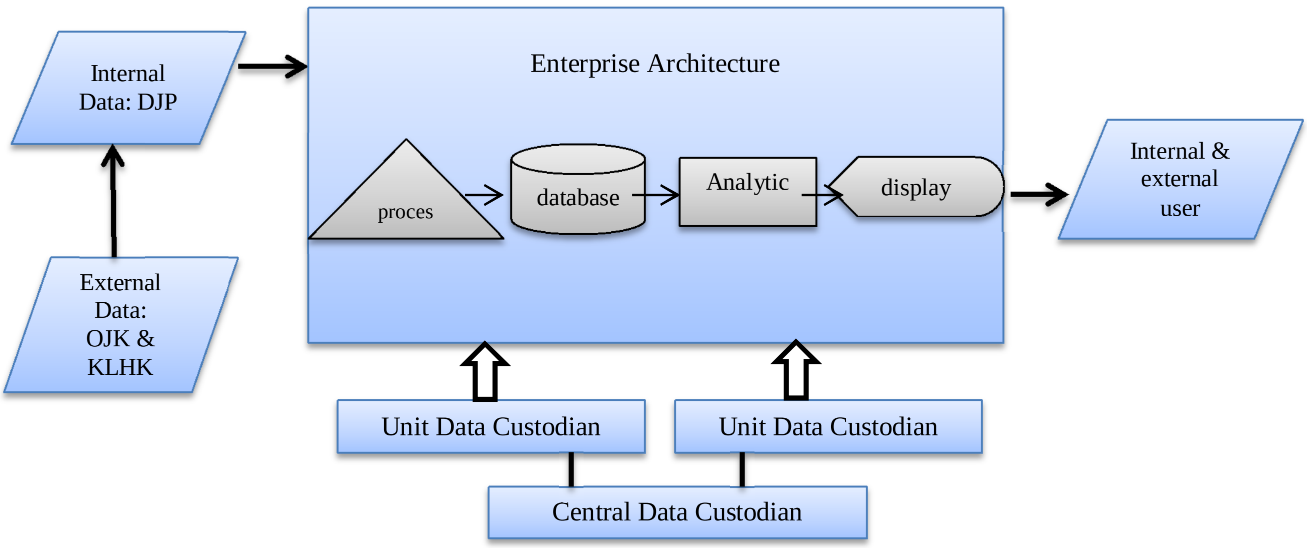
Appendix 3

Table Potential state revenue obtained from carbon permit

No	Permitted Carbon Emissions (Tonne CO_2e)	Tariff per Tonne CO_2e (US$)	Revenue (US$)	Revenue (IDR)	Total Permit Fee and Fine (IDR)
1	1.041.674.000	3	3.125.022.000	43.750.308.000.000	43.750.308.000.000
	(No over permited emissions)	20	-	-	
2	739.588.540 *(Reduced 29%)*	3	2.218.765.620	31.062.718.680.000	115.646.647.480.000
	302.085.460 *(Over permitted emissions)*	20	6.041.709.200	84.583.928.800.000	
3	614.587.660 *(Reduced 41%)*	3	1.843.762.980	25.812.681.720.000	145.396.856.920.000
	427.086.340 *(Over permitted emissions)*	20	8.541.726.800	119.584.175.200.000	

Appendix 4

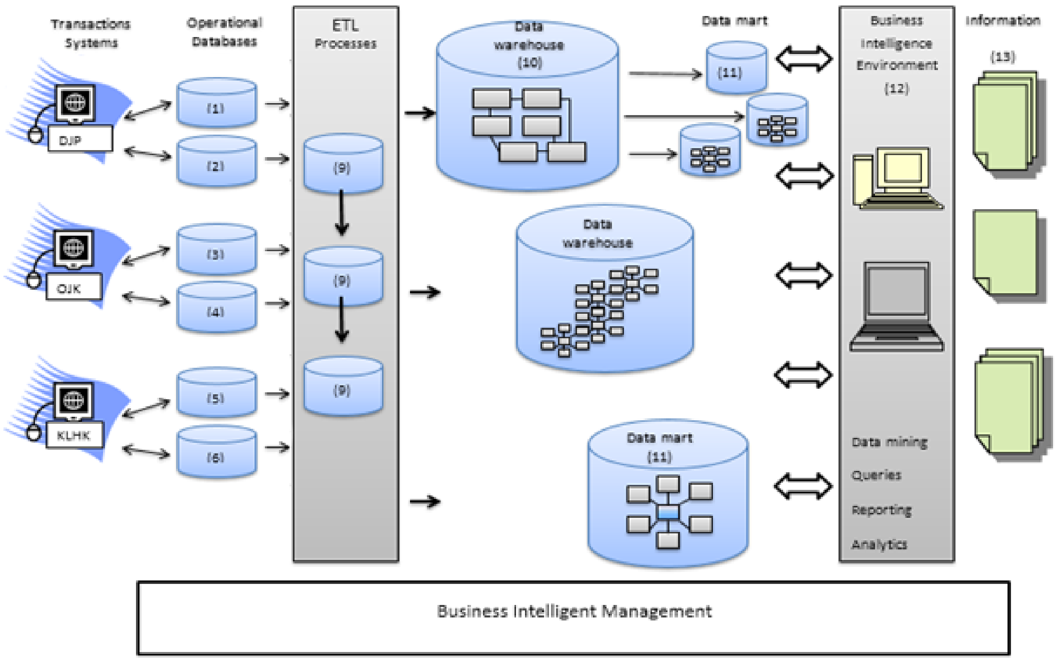
Figure Data Exchange and Data Service System



Source: processed, adapted from Turban & Volonino (2011)

Appendix 5

Figure Enterprise Architecture for Data Service System



Source: adapted from Turban & Volonino, (2011)

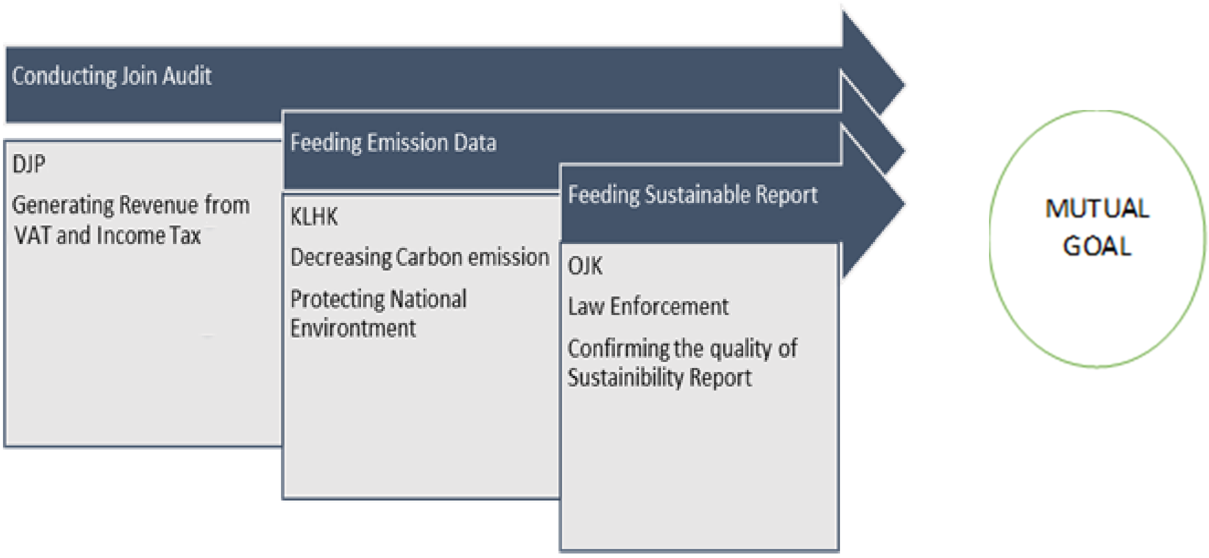
Marks;

(1) Tax report and financial report on tax return input
(2) Tax paid input
(3) Sustainibility report input
(4) Financial report input
(5) Carbon emissions report input
(6) Regulation of carbon emission quota input
(9) Data of interest are extracted, transformed and loaded into a standard format
(10) Data loaded into the warehouse
(11) Data warehouse structure consists of multiple data marts that focus on a single subject (or functional area)
(12) Joint dashboard for every party, available for access, report and analysis
(13) Information of a certain taxpayer, integrated, reliable and updated

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Appendix 6

Figure. Collaboration Task Force



Source: processed